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Allis-Chalmers Company

ENGINE STORAGE

Crushing and Cement Machinery Department

Bulletin No. 1441

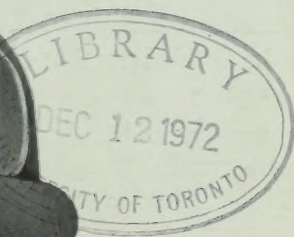
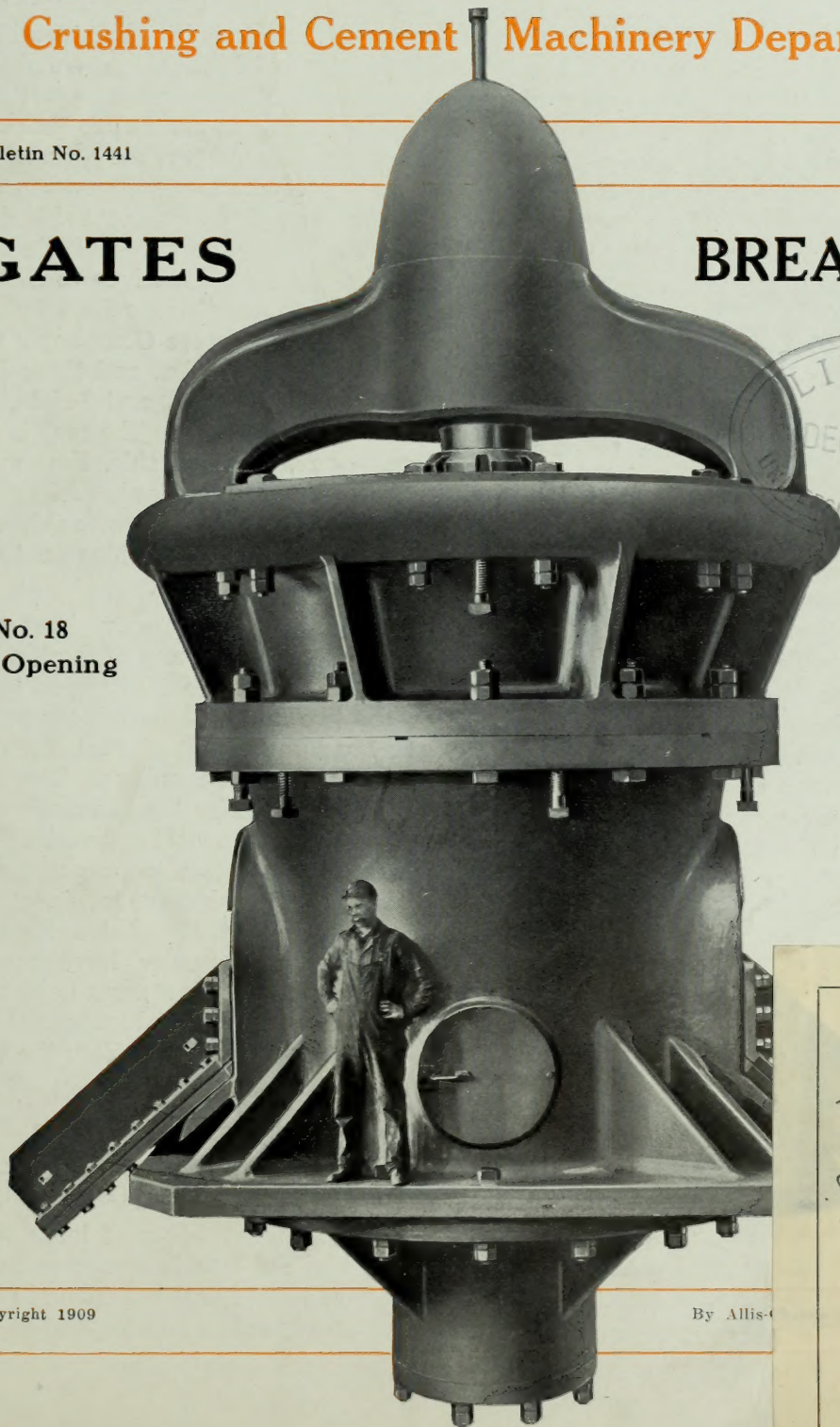
November, 1909

GATES

BREAKERS

No. 18
36'' Opening

No. 21
42'' Opening



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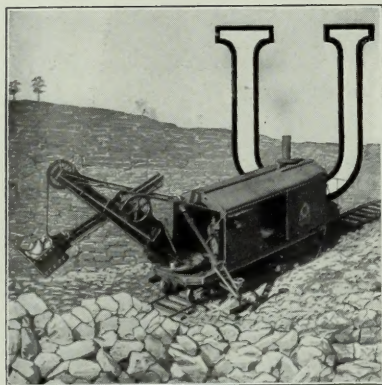
By Allis-Chalmers

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Large Gates Breakers For Use In Connection With Steam Shovels

By H. SCHIFFLIN

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UNTIL within late years the method of quarrying was to drill and blast the rock from the working breasts in large masses, only a little of which would be small enough

to be loaded by hand into low quarry cars.

The larger proportion of the rock, consequently, had to be re-drilled and re-blasted until small enough to be handled by hand. This expensive method of operation led to the adoption of steam shovels in the larger quarries, as by their use much of the re-blasting could be avoided, the men employed in loading the cars dispensed with, and larger quarry cars used. To make this method of operation effective it became necessary to design Rock Breakers of larger size than had before been built, with feed openings capable of receiving any stone which can be economically handled by the steam shovel. This led to the placing on the market of the No. 9 Gates Breaker with receiving openings 21"x 76" and a breaking capacity of 200 to 300 tons per hour. The No. 9 breaker has been, until lately, the standard for this class of work and was, until other conditions changed, eminently satisfactory.

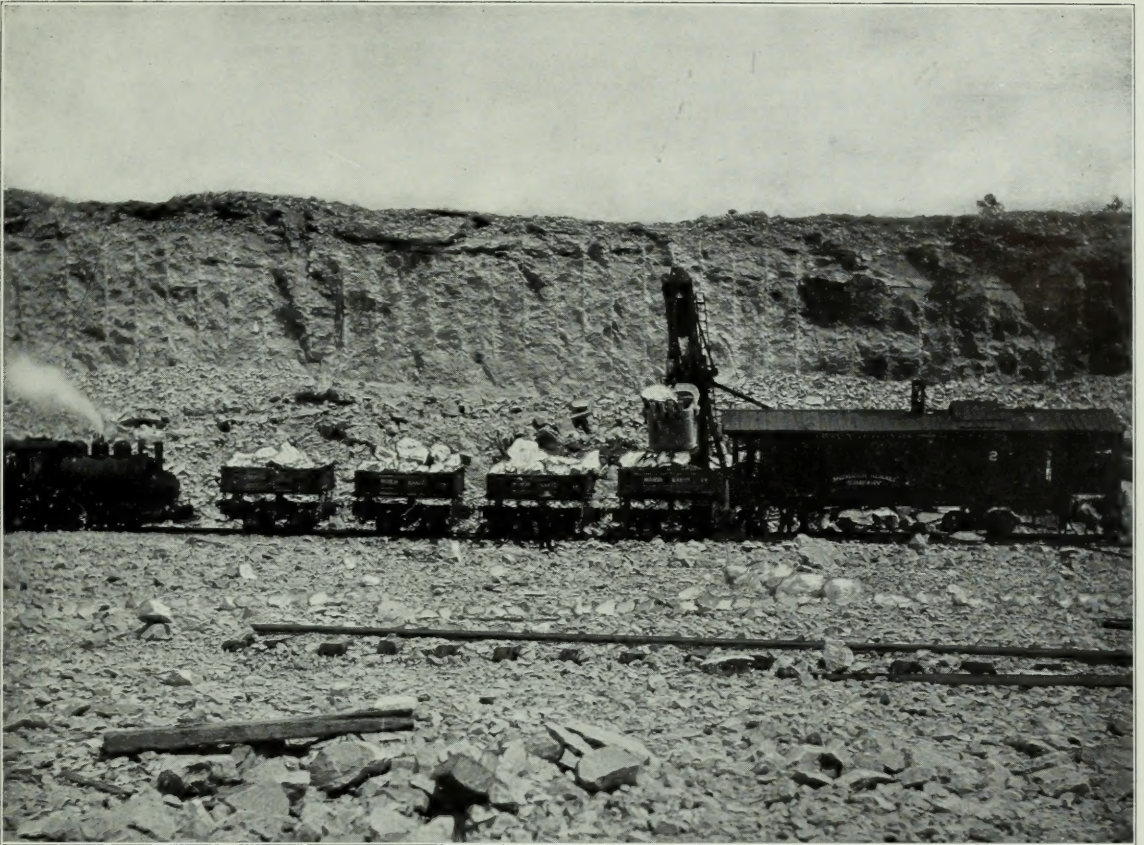
The desire for further economies has led to the use of much larger steam shovels in order that still less re-drilling and re-blasting may be necessary and this ultimately led to the demand for larger breakers. To meet this demand Allis-Chalmers Company has designed and built the largest rock breakers ever made, namely, the No. 18 and 21 Gates Rock and Ore Breakers.

For two years one of these gigantic breakers of the No. 18 type has been in operation at the plant of the Michigan Alkali Company, Alpena, Mich., with such satisfactory results that another one is now in course of erection. In this quarry, the rock, after having been blasted, is loaded by steam shovels, having three-yard dippers, into side dumping cars of ten-tons capacity. A train of these cars is hauled by locomotives to the foot of inclines, where they are raised by friction hoists of Allis-Chalmers Company's make to the mouth of the breaker and there dumped. There are two inclines and hoists, one on each side of the breaker. The rock is dumped alternately from either side, thus making a practically continuous feed. After passing the breaker, the rock is screened, elevated and deposited in storage bins in the usual way, ready for shipment.

Allis-Chalmers Company has also received orders for breakers of the No. 18 type, 36" opening, and a No. 10 type, 24" opening, from the two largest iron mining companies on the Scandinavian Peninsula, for crushing the hardest kind of iron ore. The selection of these machines by the thorough and well trained engineers sent to America by these large foreign interests to purchase the very latest and best crushing machinery, proves beyond doubt that the Gates Breakers of Allis-Chalmers Company have maintained the foremost position always held by them. An order for two No. 21 breakers, 42" opening, has also been received from the Casparis Stone Company. These breakers are guaranteed to crush trap rock.

No. 18 and 21 Gates Brakers

These large breakers were designed to fill the demand for machines of large receiving opening and for use in quarries producing large quantities of crushed stone, in order to reduce the expense of quarrying to the full



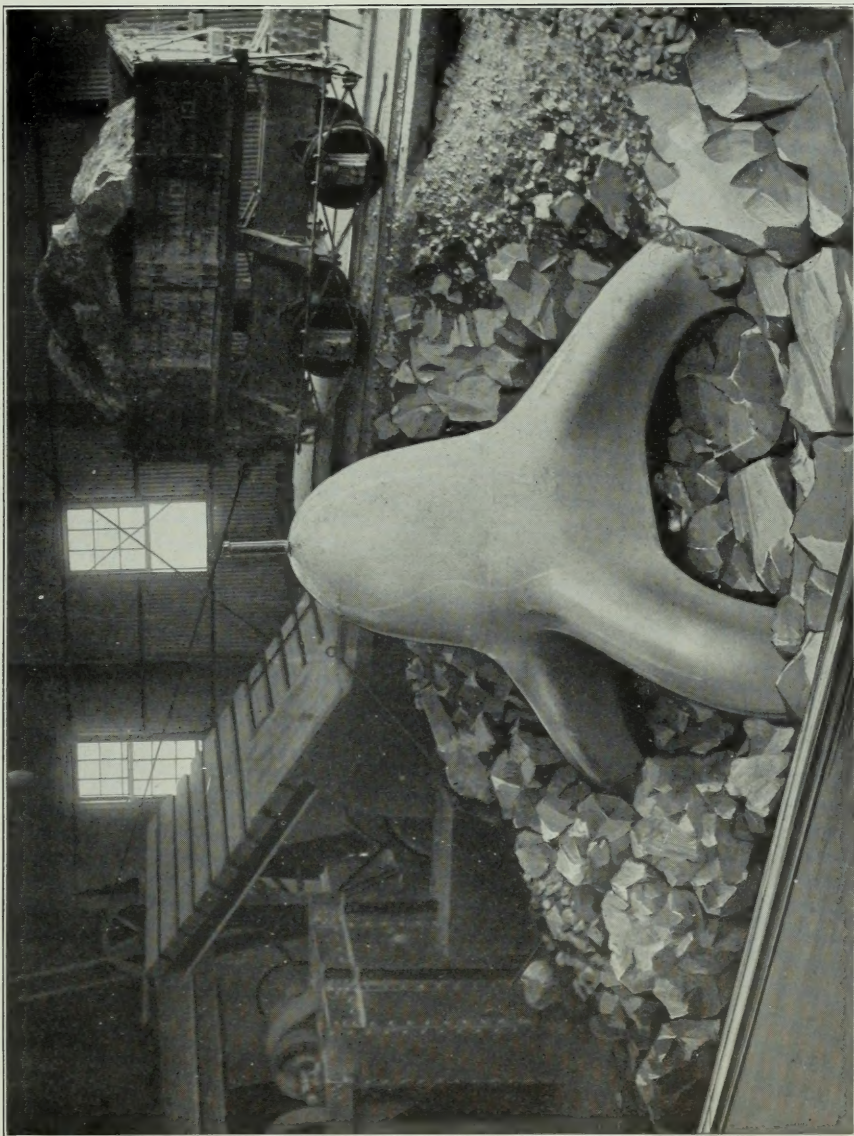
110 Ton Steam Shovel Loading 10-yard Cars.—Quarry of Michigan Alkali Co., Alpena, Mich.



Steam Shovel at Work in Limestone Quarry of Michigan Alkali Co., Alpena, Mich.



No. 18 Breaker—Two Arm Spider.



No. 18 Breaker—Four Arm Spider.

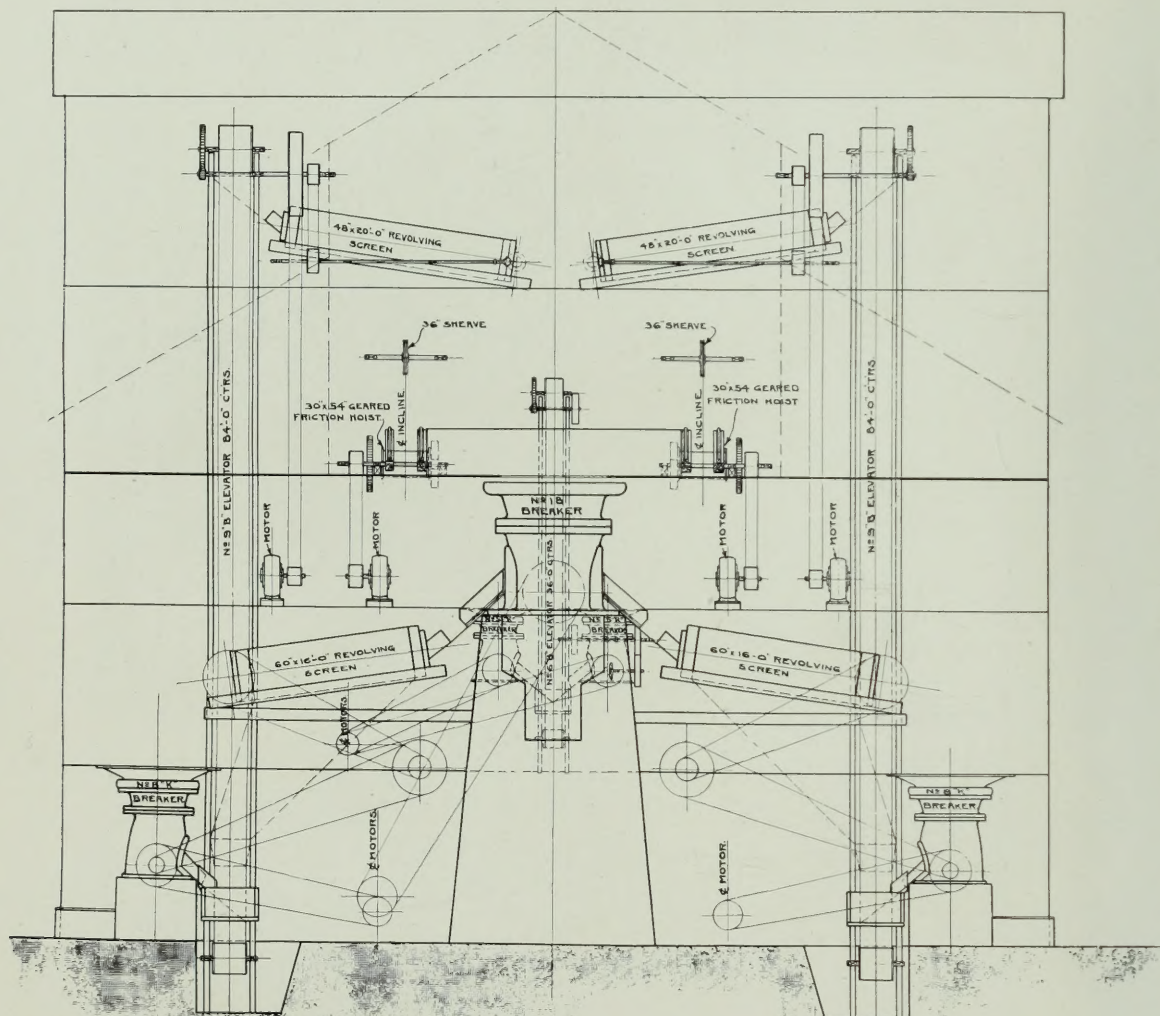
extent consistent with the present development of handling apparatus as applied to that art.

With this idea the engineers of Allis-Chalmers Co., designed and proportioned each member of the machines to perform the heavy service intended, instead of following out the same general design of the largest breaker

or where a product of 5" or larger may be used), but they are designed as sledgers to eliminate, as far as possible, re-blasting in the quarry, and it is intended that the large breakers be followed by smaller machines for further reduction.

SPIDER:

The spider is of the high arched type, the

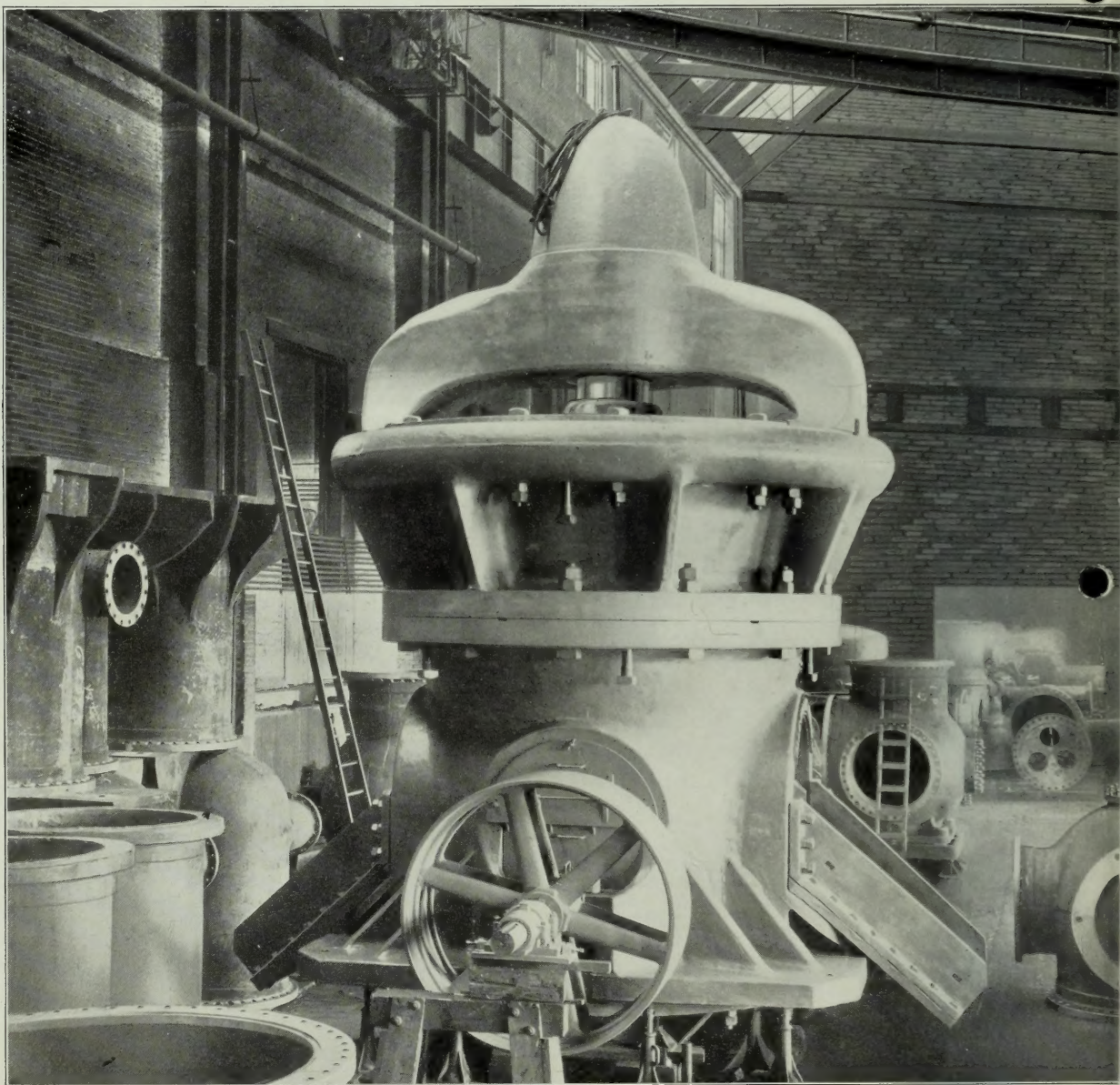


End Elevation of Crushing Plant Equipped with one No. 18, two No. 8 and two No. 5 Gates Gyratory Breakers.

previously built, thereby obtaining the maximum strength and rigidity.

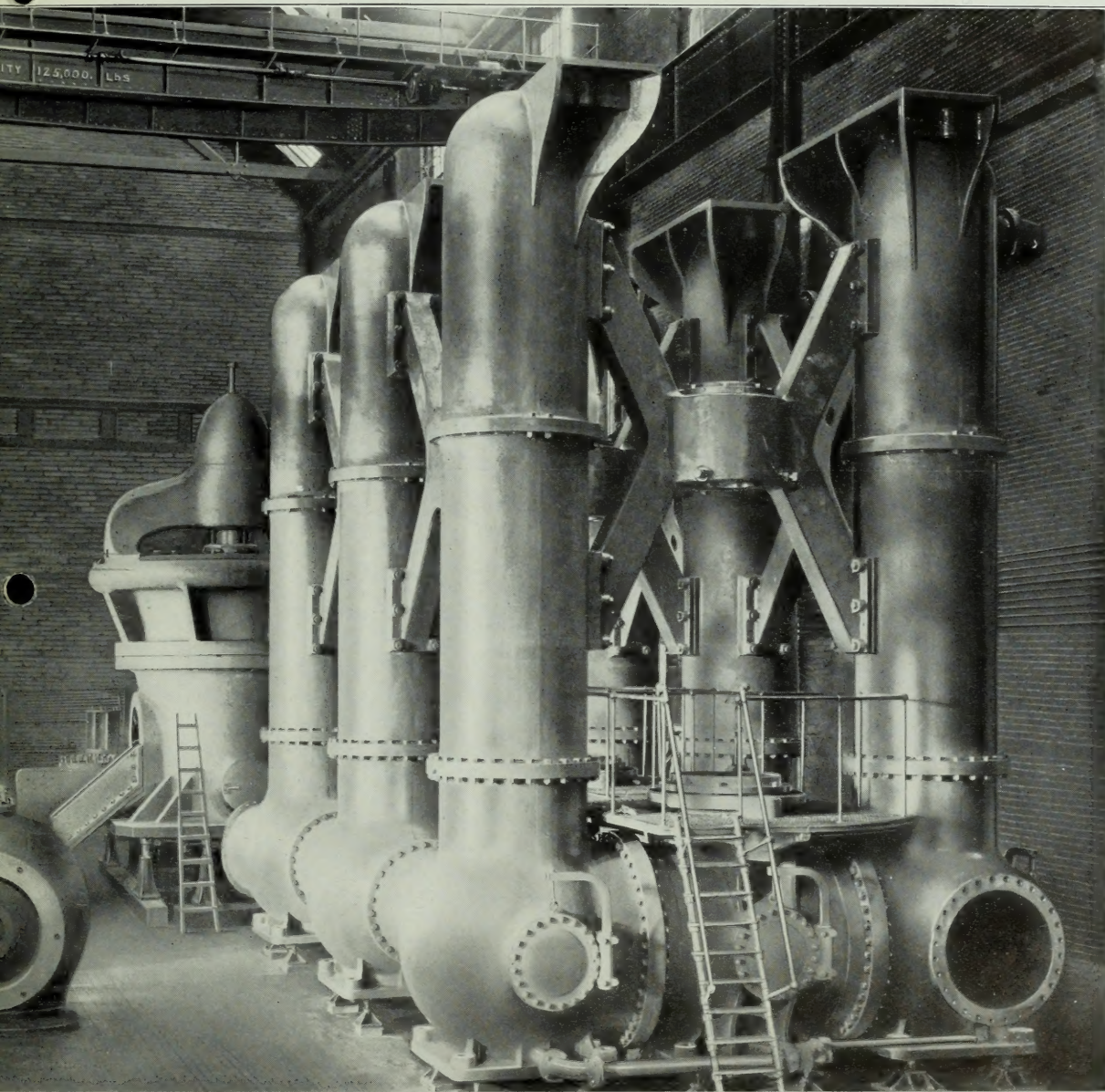
These breakers are not intended for finishing machines to reduce rock to such a size as can be used for commercial purposes without recrushing (except for blast furnace flux

arms being arched widely over the top of the head and concaves. This construction permits of a free opening to the crushing surfaces and prevents any bridging of the rock when dumped into the machine. The material fed to the breaker does not pass over



TWO No. 18 GATES BREAK

At the right is the Water End of a Vertical Triple Expansion Deep Pit Pumping Engine,

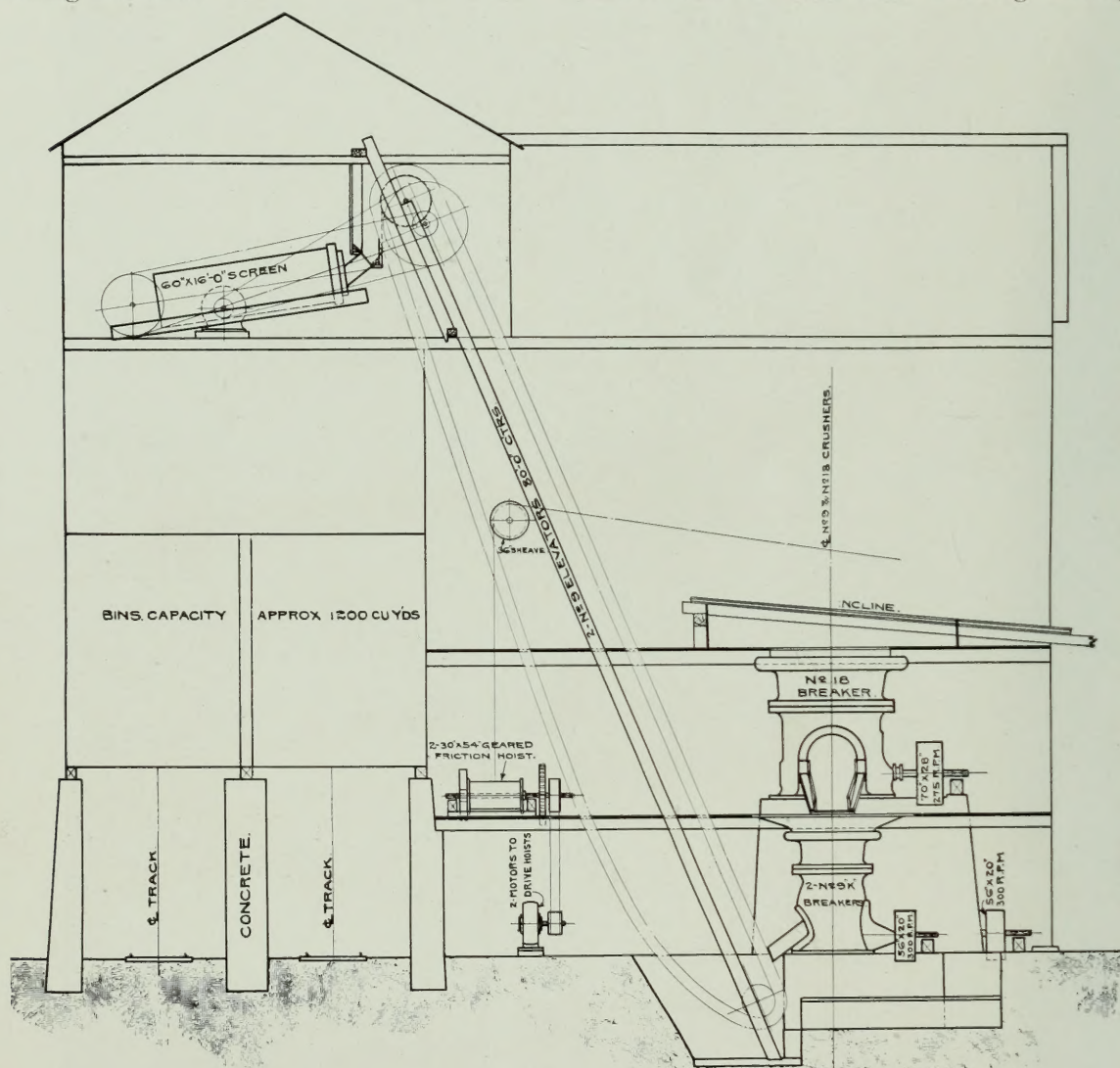


IN THE ERECTING SHOP.

of 20,000,000 gallons daily capacity, built for the San Antonio (Tex.) Water Works.

the arms of the spider making it necessary to protect them with heavy wearing plates, neither does it pass over the spider rim, but any size rock which can be gotten into the mouth of the breaker passes directly to the crushing surfaces.

construction eliminates all internal strains usually found in continuous rim spiders. The under side of the arms are perfectly smooth, having no pockets whatever in which pieces of rock can catch. The head of the spider is fitted with a removable bushing having a

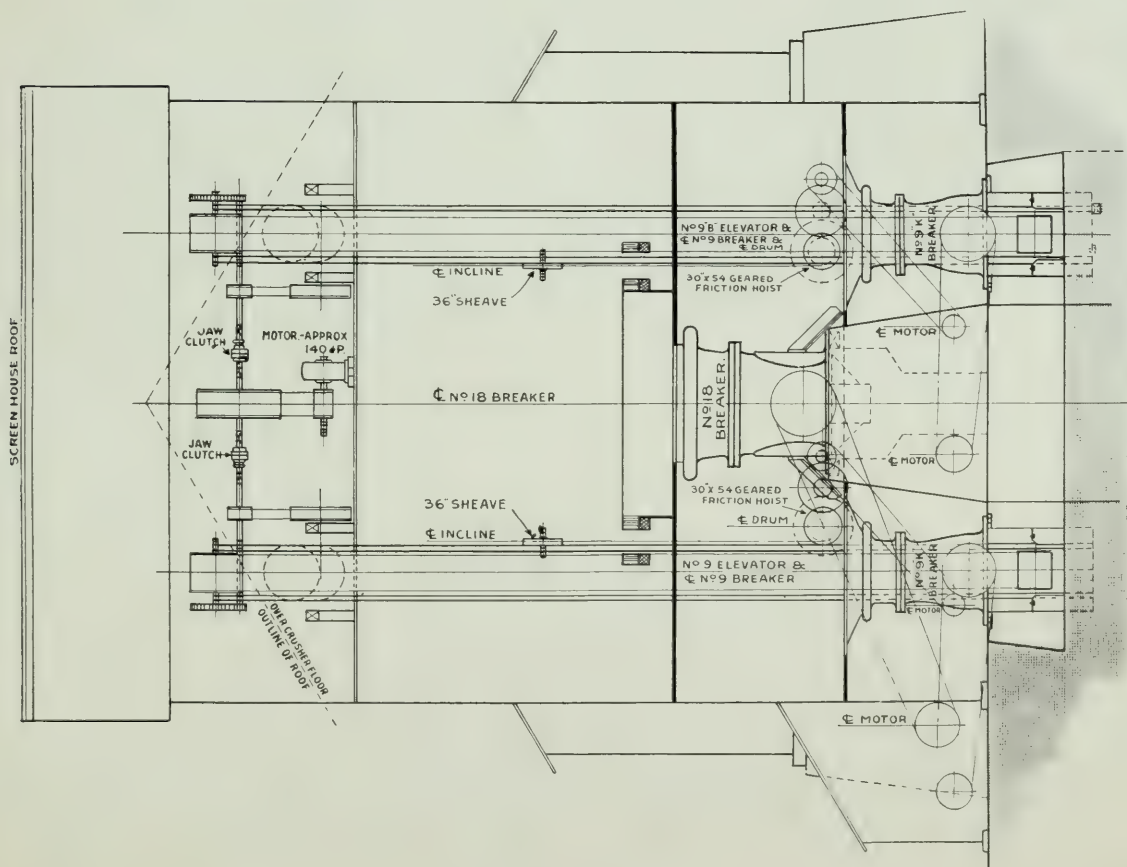
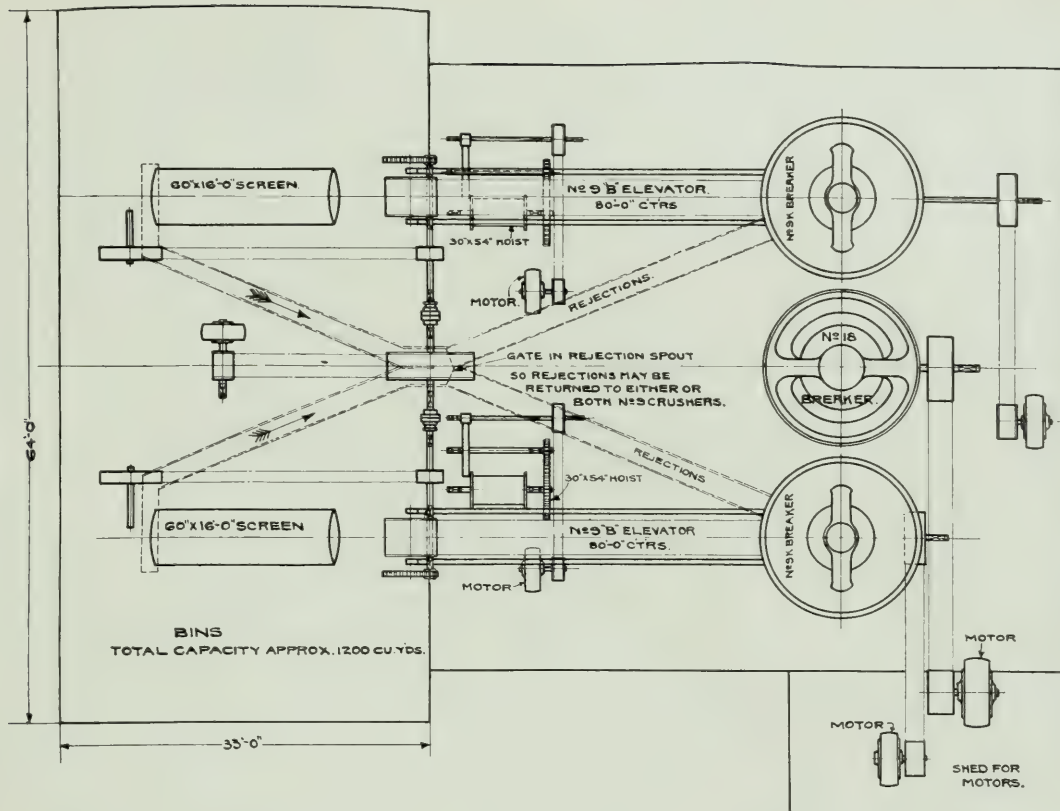


Side Elevation of Crushing Plant Equipped with No. 18 and two No. 9 Gates Gyratory Breakers.

The spider rim is fitted into a recessed flange in the top shell which holds it securely in place and resists strains in every direction. The rim, while not continuous, has tapered wedges between the sections, which construction has the effect of holding the spider much firmer than if the rim were continuous. This

taper fit so as to be easily removed in the event of replacement.

Above the spider is placed a dust cap made in two parts. It is necessary to remove only the upper and lighter section of this dust cap to inspect the top journal and suspension device. The high arched construction of the



spider makes it possible to keep the dust cap at an altitude well above the material being fed to the breaker. The rock entering the machine does not pass over the cap at all, so as to wear it and therefore necessitate a very heavy cap.

The spider is furnished with two arms or four arms as the conditions warrant.

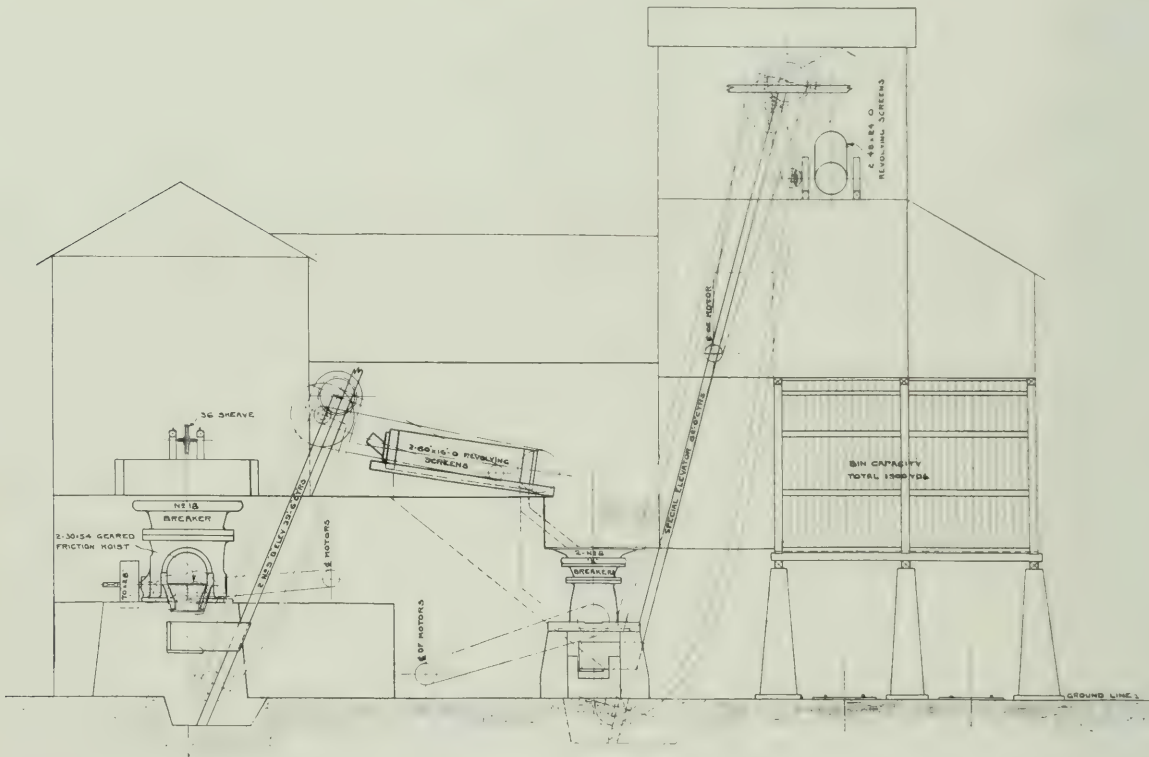
TOP SHELL:

The top shell is made very heavy of cast iron and has a recessed flange at the top to receive the spider rim. The joint between

two. They are supported at the bottom by an iron sectional removable ring, extend to the upper edge of the top shell, and are not covered in any way by the spider rim. The concaves may be replaced without disturbing the spider.

Any rock entering the breaker does not pass over the spider rim, rapidly wearing this expensive casting; but immediately falls between the crushing surfaces on entering the breaker.

Concaves are furnished of special chilled



Side Elevation of Crushing Plant Equipped with No. 18 and two No. 8 Gates Gyratory Breakers.

the top and bottom shell is a tapered fit and both the top and bottom flange are of heavy construction reinforced by wide ribs. The crushing angle between the head and concaves has been carefully determined and found to be the best for the purposes for which the breaker is intended.

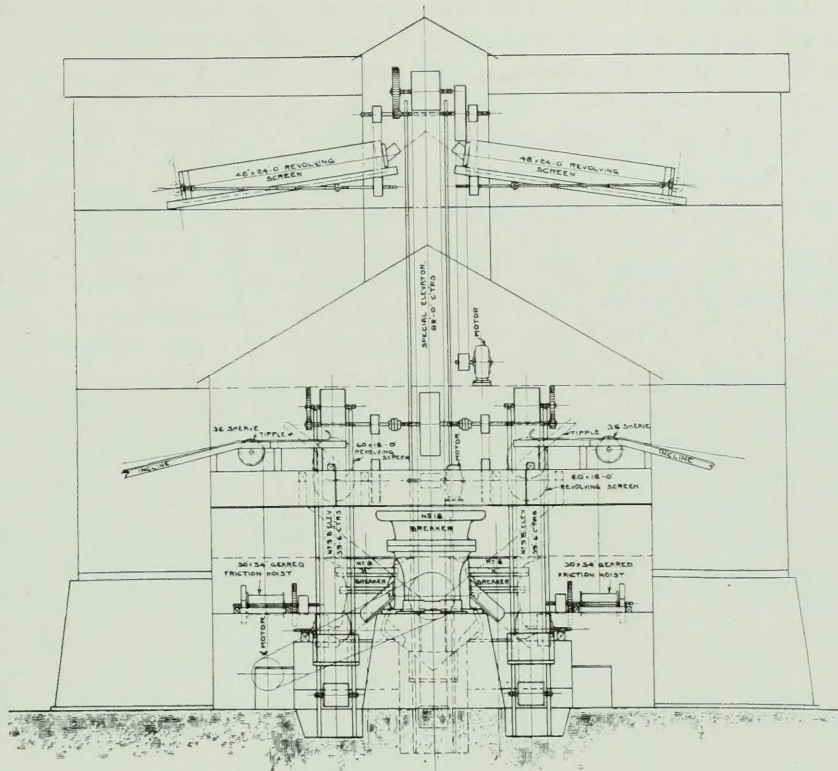
CONCAVES:

The concaves are made sectional, each in three parts, so that it is possible to replace any single section without replacing the other

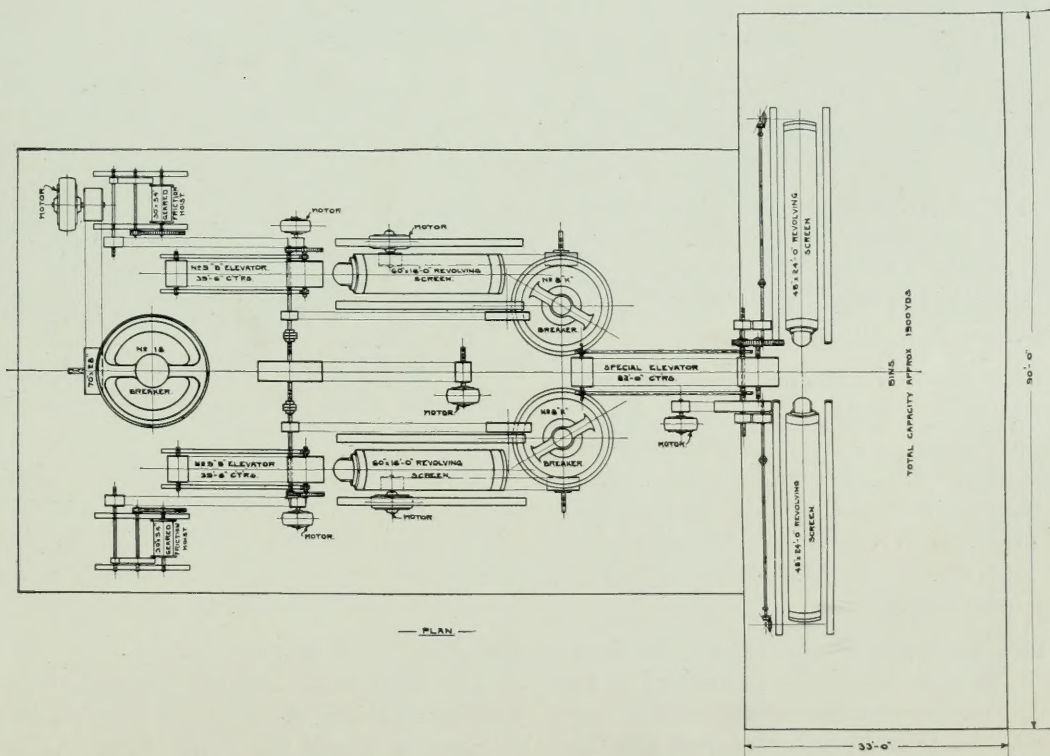
iron or manganese steel as may be desired.

BOTTOM SHELL:

The bottom shell is of close grained cast iron of extra heavy construction. The diaphragm and inner sides of the shell are lined with removable hard iron wearing plates. The spouts, which are strongly bolted to the mouth of the breaker, are of hard cast iron; the bottom and two sides are separate, and bolted together so that either of these pieces may be replaced when necessary.



END ELEVATION.



Crushing Plant Equipped with No. 18 and two No. 8 Gates Gyratory Breakers.

A man hole is provided in the side of the shell through which the gears may be easily lubricated while the machine is in operation. This manhole is large enough for a man to pass through for purposes of inspection when the breaker is not running. The opening is covered with a large steel plate door pivoted at one side so as to be easily opened and closed. There is also an opening in the shell through which the main pinion may be passed to place it in position. This opening is covered by a cast iron dust door made in two parts and hinged together so that the gears may be easily inspected by simply lowering the upper portion of the door.

The countershaft bearing is cast integral with the bottom shell, unless for shipping reasons it becomes necessary to split the bottom shell; in this case the bearing is made separate. The inner end and two faces at the center line of the shaft are machined in exact alignment with the center line of the shell, so that, with the use of the special babbitting mandrel which is furnished with the breaker, this bearing may be at any time rebabbitted with the certainty of obtaining exact alignment.

The countershaft bearing is of the chain oiling type and the base is made with a large oil reservoir of ample size to hold a supply of oil sufficient for several days' operation of the breaker.

The base of the bottom shell is extended to rest on the foundation and to permit of the bottom plate being dropped so that the eccentric and gear can be removed without in any way disturbing the bottom shell.

Allis-Chalmers Company manufactures these breakers with both a single and double discharge opening. In most cases, however, the double discharge opening for a breaker of this size is recommended, as this construction admits a better distribution of the material to auxiliary machinery in the plant than does the single discharge.

Allis-Chalmers Company also builds these breakers with a double discharge opening fitted with a device so that either one of the discharge openings may be cut off at the top of the diaphragm, at any time, giving the

breaker temporarily a single discharge opening in case the conveyor or either side is disabled.

BOTTOM PLATE:

The bottom plate is of very heavy construction having a tapered joint between it and the bottom shell. Large oil passages are cast in the hub for the rapid and free circulation of oil for the eccentric bearing. Arrangements are also provided for draining oil chambers and for conducting oil that overflows to receptacles.

Oil circulation is induced by capillary attraction for the oil of both the eccentric and the main shaft journal. Large oil holes are cast in the top of the eccentric to allow the oil which rises from the main shaft journal to flow through them back to the reservoir underneath the shaft. The oil coming up the eccentric journal must pass the brass wearing ring which supports the eccentric, and in so doing thoroughly flushes it before it reaches the passages to the reservoir.

This oiling device is the same as has been used on all size Gates Breakers for many years past, and its simplicity and efficiency accounts for its unqualified success among the thousands of machines that are fitted with it.

An oil pump is furnished with the breaker to force fresh oil into the oil passages when necessary.

The bottom plate is provided with a removable cast iron bushing of taper fit so as to be easily replaced when worn.

GEAR AND ECCENTRIC:

The eccentric is made of a high quality semi-steel with extra large bearings babbitted their full diameter on both the inside and outside.

The gear is made of high-grade semi-steel and is riveted to the eccentric, which is the same construction as that which has been in successful operation on the smaller sizes of Gates Breakers for many years.

MAIN SHAFT AND HEAD:

The main shaft is made of high-grade steel free from sharp corners, hollow bored so as to remove from the center any defects or cracks that may be in the original forging

which, if not removed, tend to creep outward and weaken the shaft. The shaft has been carefully designed to follow the cubic parabola (the curve of uniform strength). That portion of the shaft upon which the head is fitted is of extra large diameter so that the two key seats for holding the head will not in the least weaken it and that the head may be as light as is consistent with the necessary strength.

shaft has been in use for many years on the Gates Breaker and was found, after repeated trials before it was finally adopted, to be the most effective and successful method.

The breakers can be fitted with Allis-Chalmers patented gunlock self-tightening manganese mantle if desired.

SUSPENSION :

The patented shaft suspension device con-



Steam Shovel Dipper in Act of Loading.

The head is of solid chilled iron, or a manganese steel mantle on cast iron core, bored its full length to fit the shaft, kept from turning by means of two zinc keys and held down on the shaft by a ring nut.

Zinc is used for keys instead of steel owing to the fact that zinc will not rust, and as it can be easily poured when hot in the slots between the head and shaft, forms a perfect key.

This method of attaching the head to the

sists of a bushing fitted to the hub of spider, the upper part of which has a spherical top. Upon this bushing there is mounted a crucible steel wearing ring, the under side of which is turned spherical to correspond with the upper spherical surface of the spider bushing, and the upper side of the wearing ring is flat. The suspension collar which is made in two parts, clamped securely to the shaft and prevented from rotation by two feather keys, rests directly on the upper flat surface of the wearing ring. With this type of suspension a full and

perfect bearing is secured. Oil for this bearing is introduced through a pipe in the top of the dust cap. The dust cap need not be removed except for inspection of the suspension device.

COUNTERSHAFT:

The countershaft is very liberal in diameter and will not deflect under strains coming upon it. The main pinion is of high-grade cast steel made to accurate pitch, keyed to the inner end of the countershaft. The teeth of the pinion are made of special shape so that the strength at the root of the tooth is equal to that of the gear. The outer end of the countershaft is fitted with an outboard bearing which is self-oiling and mounted on a heavy cast iron sole plate.

The driving pulley is of the double arm type, extremely heavy and made with a clamped hub secured to the shaft by means of key.

EQUIPMENT:

With the No. 18 and No. 21 Gates Breakers are furnished one set of babbitting sleeves for re-babbitting eccentric, one babbitting mandrel for re-babbitting countershaft bearing, complete set of wrenches, set of lowering rods for lowering bottom plate, eye bolt for raising and lowering main shaft, foundation bolts and washers.

ALLIS-CHALMERS CO.'S MATERIAL:

The builder of this machine uses special mixtures of iron to make the castings strong, hard and tough and free from blow holes. As each part of the breaker requires its own peculiar mixture, a laboratory in charge of an expert chemist is operated in connection with the shops. All pig and wrought iron, coke, steel, copper, tin, zinc and oil are subjected to chemical and physical tests. The mixtures and alloys are also tested and analyzed to check up the proportions of the compositions, and records are kept of each heat for future reference. These tests make it possible to maintain the mixtures at their highest strength.

All parts of the breaker are made to gauges and templets to insure the accurate fit of duplicate parts. A complete record is kept of each machine and repairs are entered. When an order for repair parts is received it is compared with the record to minimize the chance of errors in filling it.

Allis-Chalmers Company is prepared to design and equip complete rock crushing plants to meet every condition of service, and those contemplating the erection of one may obtain many valuable hints and suggestions from Bulletin No. 1411, which can be had upon application.

Size	Size of Receiving Opening	Weight	Size of Pulley	R. P. M. of Driving Pulley
No. 18...	2 Arm Spider 2 — 36" x 96"	400,000	70" Dia. 28" Face	275
	4 Arm Spider 4 — 36" x 63"			
No. 21...	2 Arm Spider 2 — 42" x 96"	450,000	70" Dia. 28" Face	275
	4 Arm Spider 4 — 42" x 63"			